I claim:

1. A microlithographic reduction projection catadioptric objective having an image side and an object side and curved mirrors and being devoid of planar folding mirrors, comprising an aperture plane on the image side of a most imageward curved mirror.

2. A microlithographic reduction projection catadioptric objective having an object side and an image side and curved mirrors, wherein after a most imageward curved mirror the beam diverges.

3. The microlithographic reduction projection catadioptric objective according to claim 1, comprising 4 curved mirrors and more than 8 lenses.

4. A microlithographic reduction projection catadioptric objective having a system with an unobscured pupil, comprising a plurality of optical elements and having a straight axis of symmetry of all curvatures of all optical elements, wherein no more than two optical elements deviate substantially from disk form.

5. The microlithographic reduction projection catadioptric objective according to claim 3, comprising no more than one optical element that is in a substantially non rotationally symmetric form.

6. A microlithographic reduction projection catadioptric objective having an object side and an image side, consisting in sequence from the object side to the image side of a catadioptric group providing a real intermediate image, a catoptric or catadioptric group providing a virtual image, and a dioptric group providing a real image.

7. A microlithographic reduction projection catadioptric objective having an object side and an image side, comprising, in sequence from the object side to the image side, a field lens group, a catadioptric group comprising one or more negative lenses and a concave mirror, generating

axial chromatic aberration. a group comprising an odd number of curved mirrors, and a positive lens group.

8. A microlithographic reduction projection catadioptric objective having an object side and an image side, comprising, in sequence from the object side to the image side, a catadioptric group comprising one curved mirror and having a negative reduction ratio, a group comprising an odd number of curved mirrors and having a positive reduction ratio, and a dioptric lens group having a negative reduction ratio.

9. The objective according to claim 6, wherein the catadioptric group comprises a positive field lens group and a negative lens group next to a mirror, and wherein the dioptric lens group comprises more positive than negative lenses.

10. A microlithographic reduction projection catadioptric objective, having an object side and an image side, comprising an even number greater than two of curved mirrors, with an unobscured system aperture and including more lenses than curved mirrors, being devoid of planar folding mirrors and comprising an aperture plane on the image side of a most imageward curved mirror.

11. A microlithographic reduction projection catadioptric objective having an object side and an image side, comprising an even number greater than two of curved mirrors, with an unobscured system aperture and including more lenses than curved mirrors, wherein after a most imageward curved mirror the beam diverges.

12. A microlithographic reduction projection catadioptric objective, comprising 4 curved mirrors and more than 8 lenses forming a system with an unobscured pupil, comprising a straight axis of symmetry of all curvatures of all optical elements, wherein no more than two optical elements deviate substantially from disk form.

13. A microlithographic reduction projection catadioptric objective having an object side and an image side, comprising more than two curved mirrors and no more than one optical element that is in a substantially non rotationally symmetric form, consisting of, in sequence from the object side to the image side, a catadioptric group providing a real intermediate image, a catoptric or catadioptric group providing a virtual image, and a dioptric group providing a real image.

14. The microlithographic reduction projection catadioptric objective according to claim 2, comprising, in sequence from the object side to the image side, a field lens group, a catadioptric group comprising one or more negative lenses and a concave mirror, generating axial chromatic aberration, a group comprising an odd number of mirrors, and a positive lens group.

15. The microlithographic reduction projection catadioptric objective according to claim 4 having an object side and an image side, comprising, in sequence from the object side to the image side, a catadioptric group comprising one curved mirror and having a negative reduction ratio, a group comprising an odd number of curved mirrors and having a positive reduction ratio, and a dioptric lens group having a negative reduction ratio.

16. The objective according to claim 15, wherein the catadioptric group comprises a positive field lens group and a negative lens group next to the curved mirror, and the dioptric lens group comprises more positive than negative lenses.

17. A microlithographic reduction projection catadioptric objective having an object side and an image side, wherein a most imageward mirror is convex.

18. The objective according to claim 1, further comprising a straight axis of symmetry of all curvatures of all optical elements.

19. The objective according to claim 2, comprising an intermediate image, with at least two mirrors being arranged upstream in the path of the beam.

20. The objective according to claim 6, wherein the image side numerical aperture is NA = 0.7 or greater, at an image field of 5 mm x 20 mm to 8 mm x 30 mm.

21. The objective according to claim 1, wherein all lenses built in as full disks do not obstruct a beam path.

22. The objective according to claim 3, comprising at least one spherical mirror.

23. The objective according to claim 18, wherein the curved mirrors have optical surfaces that comprise sections or full surfaces of revolution.

24. The objective according to claim 3, comprising, in sequence from an object plane end, a first and a third curved mirror that are concave and a fourth mirror that is convex.

25. The objective according to claim 7, comprising an aperture plane located within a catadioptric chromatic aberration generating group comprising at least one negative lens and a concave mirror.

26. The objective according to claim 1, comprising a field lens group next to an object plane and being object side telecentric.

27. The objective according to claim 4, wherein the optical elements comprise lenses that are all located within a cylindrical envelope of minimal radius, and curved mirrors, all but one of the curved mirrors being located within a same envelope.

28. Projection exposure apparatus comprising a projection objective according to claim 1, an excimer light source, an illumination system, a reticle handling, positioning and scanning system, and a wafer handling, positioning and scanning system.

29. Projection exposure apparatus comprising a projection objective according to claim 2, an excimer light source, an illumination system, a reticle handling, positioning and scanning system, and a wafer handling, positioning and scanning system.

30. Projection exposure apparatus comprising a projection objective according to claim 4, an excimer light source, an illumination system, a reticle handling, positioning and scanning system, and a wafer handling, positioning and scanning system.

31. Projection exposure apparatus comprising a projection objective according to claim 6, an excimer light source, an illumination system, a reticle handling, positioning and scanning system, and a wafer handling, positioning and scanning system.

32. Projection exposure apparatus comprising a projection objective according to claim 7, an excimer light source, an illumination system, a reticle handling, positioning and scanning system, and a wafer handling, positioning and scanning system.

33. Projection exposure apparatus comprising a projection objective according to claim 8, an excimer light source, an illumination system, a reticle handling, positioning and scanning system, and a wafer handling, positioning and scanning system.

34. Projection exposure apparatus comprising a projection objective according to claim 17, an excimer light source, an illumination system, a reticle handling, positioning and scanning system, and a wafer handling, positioning and scanning system.